

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

agricultural research

U.S. DEPARTMENT OF AGRICULTURE

JANUARY 1979

27/7
COR/STA

1.98
Ag84



Gifted to ALM.ORE.

APR 16 79

NATL

agricultural research

January 1979/Vol. 27, No. 7

And We Begin Again

The new year is a time for reflection and assessment and beginning again. And it is a time for hope: that the past year's experiences will bring a new clarity, a better vision of what lies ahead.

Congress has created two advisory bodies for this Department. That step will bring to Agriculture increased coordination and a clearer insight into the needs of those who are most dependent on agricultural research and extension work.

The Joint Council on Food and Agricultural Sciences is composed of research and extension people from throughout the Department; and people from colleges, private research and extension institutions, and the public. Members of the Joint Council will provide a forum where information about a wide array of agricultural work will be evaluated. With its overview, it will identify areas of duplication, and areas where research and education are needed the most. And once each year, it will present to the Secretary its recommendations for the next fiscal year.

The National Agricultural Research and Extension Users Advisory Board is the other advisory council. Like the Joint Council, the Users Advisor Board (UAB) gathers information on the direction and adequacy of many agricultural programs. But the Users Advisory Board differs from the Joint Council in that the UAB is comprised of people who represent the "end users"—those people most directly dependent on the Department's work. As members of the UAB, these people can participate in the decisionmaking process at the highest level of the Department. By including their opinions, experiences with USDA's services, and goals in its annual report to the Secretary, the UAB is responding to a governmentwide effort to broaden public participation in top level decisionmaking.

The UAB has one other responsibility which makes it singularly influential. After both new councils submit their annual recommendations to the Secretary, and the Secretary submits his proposed budget for congressional approval, the UAB then prepares a second report—an appraisal of the Secretary's recommendations and proposed budget. This second report goes directly to the President and four congressional committees. Taken together, the Joint Council and UAB provide a more effective coordination with wider public participation than has been achieved before.

For the Department of Agriculture, the new year portends a new responsiveness. The reflection and the assessments of last year have evolved into the catalysts for change—for a new clarity—a keener knowledge of what is being done and what is most needed. And with that greater understanding we can begin again.—R.W.D.

CROPS

- 7 Cocklebur cut soybean yields
- 11 Leaf blight threatens rice
- 13 Pesticides aid cotton

DISEASES

- 5 Copper deficiency in rats
- 14 Ornithosis sources identified

ENGINEERING

- 3 New energy saver
- 15 Energy saving thermostat

ENVIRONMENT

- 11 Pesticides in runoff water

HUMAN NUTRITION

- 13 Winter wheat bran promising

INSECTS

- 8 Pheromone controls red scale

MARKETING

- 12 Metrically packaged grapefruit
- 14 Japan—new cherry market

UTILIZATION

- 16 Hungarian Komondor guards sheep

AGRISEARCH NOTES

- 16 Clover germplasm resists aphids
- 16 Vitamin E helps hamsters

Editor: Howard G. Hass

Assistant Editor: Robert W. Deimel

Contributors to this issue:

Robert A. Barclay, Robert C. Bjork, F. William Brouard, Bennett D. Carrier, J. Paul Dean, Peggy L. Goodin, G. Ben Hardin, Eriks Likums, Stephen C. Miller, Walter W. Martin, Lynn C. Yarris

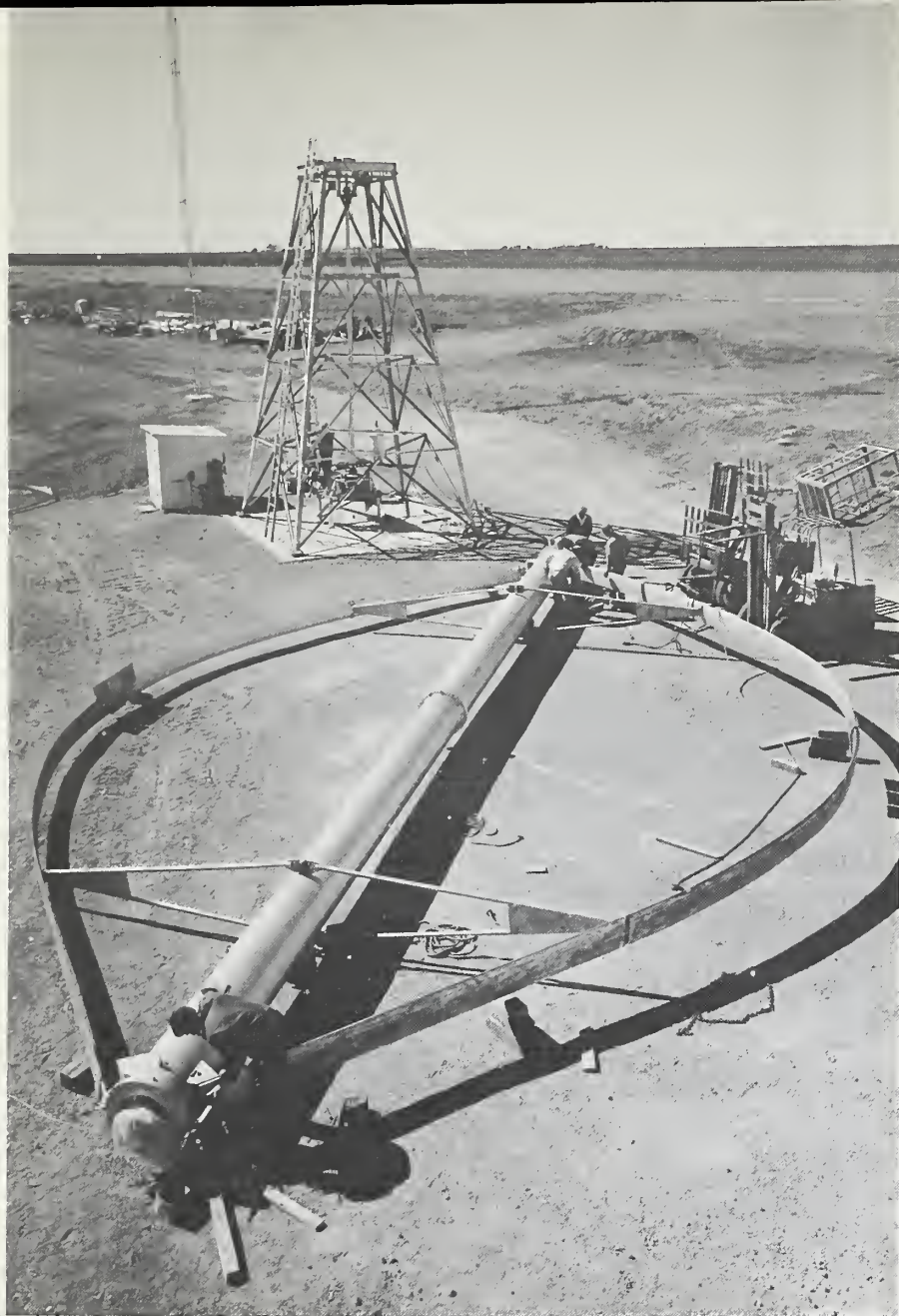
COVER: Visible fumes from a chemical (Titanium Tetrachloride), which has approximately the same molecular weight as a new synthetic sex lure for Red Scale, enable SEA researchers in California to locate the best spots for Red Scale traps (1178X1467-22A). Story begins on page 8.

AGRICULTURAL RESEARCH is published monthly by the Science and Education Administration (SEA), U.S. Department of Agriculture, Washington, D.C. 20250. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 15, 1982. Yearly subscription rate is \$10.00 in the United States and its territories, \$12.50 elsewhere. Single copies are 90 cents domestic, \$1.15 foreign. Send subscription orders to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Information in this magazine is public property and may be reprinted without permission. Prints of photos are available to mass media; please order by photo number.

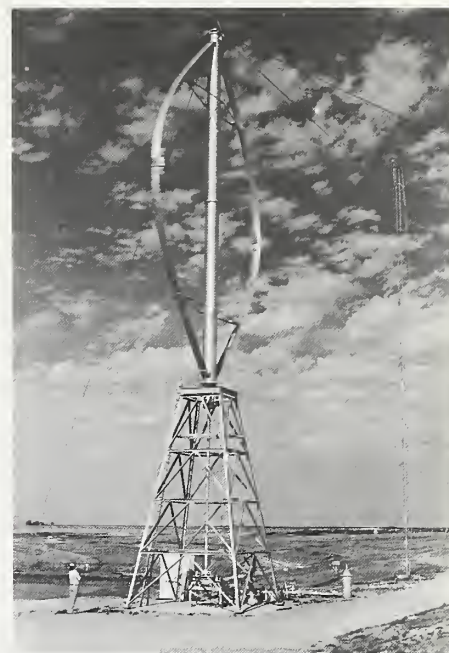
Bob S. Bergland, Secretary
U.S. Department of Agriculture

Anson R. Bertrand, Director of
Science and Education

AGRICULTURAL RESEARCH



Left: Components for this turbine came from Canada, but American firms are expected to be manufacturing similar units in the near future. Once assembled, the 7,000 lb. steel shaft and aluminum airfoil structure will be hoisted by crane onto the tower behind it (PN-4173).



Rising 57 feet above a 30-foot steel tower, this vertical axis "Darrieus" wind turbine (named for its French inventor) can harness at least 30 percent of the enormous energy carried by the wind (0678X796-29).

New Energy Saver Harnesses Wind

WIND power has been used for centuries to pump water, but the farm windmill simply does not have the capacity to irrigate field crops. Windmills usually pump about 10 gallons (37.8 liters) per minute, but several hundred gallons per minute are necessary for irrigation purposes.

Now, a unique power arrangement called a "wind-assisted system" is being tested for irrigation pumping.

At low wind speeds, an electric motor supplies all of the power to the pump. When the wind speed exceeds 13 mph (20.8 kilometers per hour), the wind turbine supplies mechanical power to the pump thereby reducing the electricity cost.

The blades of the wind turbine are airfoils that produce lift similar to that of an airplane wing and are much more

efficient than the traditional drag type blades of a farm windmill.

Agricultural engineers Nolan Clark and Arland Schneider point out that the wind-assisted system has two main advantages over systems that rely solely on wind power: water is pumped at the desired rate and pressure regardless of wind power, and a conventional irrigation well and vertical turbine pump are used without modification. Also, since the electric motor supplies only part of the power, the system saves electricity. Clark says the "wind-assisted sys-

tem is presently the only one of its kind in the world."

The vertical-axis wind turbine, which has produced 70 horsepower in a 43 mph (68.8 kilometer per hour) wind, is mechanically coupled to a vertical turbine pump through a commercially available combination gear drive. When the wind turbine is producing power, it rotates at a constant speed of 90 rpm. Speed increasers installed at the bottom of the drive shaft beneath the rotor increase shaft speed up to 1,780 rpm for the pump. The system also has a large

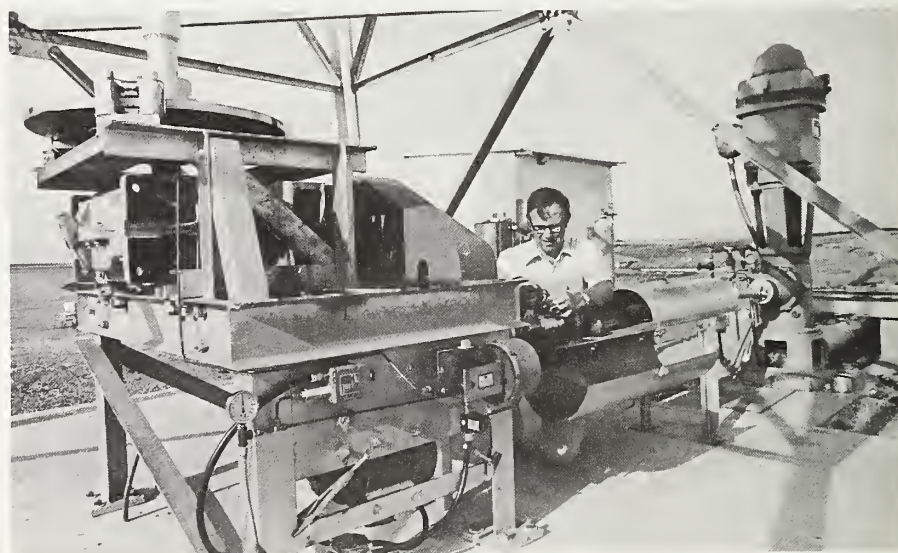
disk brake, and a clutch in the wind turbine drive shaft that makes reverse transfer of power from the motor to the turbine impossible.

The research is funded by the Department of Energy. Drs. Nolan Clark and Arland Schneider are located at the Southwestern Great Plains Research Center, Bushland, TX 79012. These SEA scientists are working with Drs. Vaughn Nelson, Earl Gilmore, and Bob Barieau at the Alternative Energy Institute, West Texas State University, Canyon, TX 79015.—B.D.C.

Right: Dr. Clark adjusts the flow rate for an individual furrow in a corn field irrigated by SEA's experimental wind power installation in Bushland, TX. The water comes from a conventional irrigation well capped by a commercially available vertical turbine pump. Four hundred gallons per minute are pumped through the irrigation pipes (0678X797-7A).

Far Right: Dr. Schneider checks tension on one of the four guy lines that keep the rotor upright. The $\frac{7}{8}$ -inch thick steel cables are each maintained at a tension of 8,000 pounds (0678X794-31A).

Below: One big advantage of the Darrieus turbine system is that essential machinery for the irrigation pump can be located at ground level. Here, based directly under the turbine, are gear assemblies to raise the drive shaft speed for the irrigation pump to 1780 rpm. A wind-assisted electric motor above the pump is coupled to the gears and is easily accessible, as demonstrated by Dr. Clark (0678X796-3).



Copper Deficiency in Rats

EVIDENCE linking low-copper diets with coronary heart disease, the leading cause of death in the United States has been strengthened by results of studies on laboratory rats.

Science and Education Administration human nutrition researchers found that rats fed a low-copper and cholesterol-free diet had higher concentrations of cholesterol in their blood plasma than did rats on a copper-supplemented control diet. Now, studies conducted by researchers at the same Human Nutrition Laboratory, Grand Forks, N. Dak., have also determined distribution of cholesterol in plasma of rats on copper-deficient diets.

The distribution is similar to that many medical authorities have associated closely with intensified risk of atherosclerosis in humans, says SEA medical officer Leslie M. Klevay.

Atherosclerosis is a disease in which fatty substances collect in artery walls. These deposits, which are partially made up of cholesterol, gradually reduce the amount of blood that reaches cells in the heart and other organs until injury results.

Dr. Klevay and a University of North Dakota collaborator, biochemist Kenneth G. D. Allen who is now working at Colorado State University, measured the amounts of cholesterol that were bound to lipoproteins of various densities in the rats' blood plasma. Cholesterol that an animal or human body synthesizes or cholesterol that is supplied in the diet is needed by each cell in the body, and lipoproteins have a role in moving cholesterol into and out of the cells, Dr. Klevay says.

The researchers found that copper

deficiency more than doubled cholesterol concentration in the plasma. The deficiency also resulted in a decreased percentage of the total plasma cholesterol that was bound to high-density lipoprotein (HDL) and increased the percentage bound to low density lipoprotein (LDL).

What is the implication of these observations? Scientists at several research institutions have conducted studies which show that less than normal percentages of HDL cholesterol in blood plasma may increase a person's risk for atherosclerosis, especially if LDL and very low-density lipoprotein (VLDL) is abundant.

"In our studies on copper deficient rats we found LDL and VLDL cholesterol were abundant," said Dr. Klevay. The copper-deficient rats had 187 and 252 percent more of these forms of cholesterol, respectively, than rats on the control diet.

Dr. Klevay says the findings underscore a need for more study on the copper content of human diets in relation to the incidence of heart disease.

In earlier studies, Dr. Klevay compared the copper content of 47 fresh foods in 1942 with the copper content of the same kinds of food that were purchased in 1966. Thirty of the foods contained less copper in 1966.

Dr. Klevay also observed that an increase in the death rate attributable to arteriosclerosis accompanied what at least appeared to be a decline in copper available in foods. Between 1949 and 1967 that death rate increased 44 percent. Arteriosclerosis is a disease in which arterial walls abnormally thicken and harden.

In other research involving 20 diets, Dr. Klevay found that dietary copper content averaged only about 1 milligram (mg). All of these diets had been prepared by professionals in hospitals and educational institutions. Only two of the diets contained as much as 2 mg of copper.

The National Academy of Sciences-National Research Council had suggested that adults should consume at least 2 mg of copper per day, but it has not as yet suggested a recommended dietary allowance (RDA). When the Council establishes RDA's, it recognizes that the availability of nutrients for intestinal absorption varies among foods.

Most nutrition tables provide dietitians with less than adequate information on the amount of copper in various foods and the extent to which this trace mineral can be digested, absorbed, and used by humans. "Although little information is available, we know that nuts, seeds and beef liver generally are rich in copper," Dr. Klevay says.

Careful menu planning with a wide variety of foods may allow diets to have ample copper without excluding any particular food, Dr. Klevay says. More information for planning menus will be needed if low consumption of copper in diets is proven to be a public health problem.

Dr. Leslie M. Klevay is with the Human Nutrition Research Laboratory, 2420 Second Avenue North, University Station, Grand Forks, ND 58201.—*G.B.H.*

Hungarian Komondor Guards Sheep

COYOTES won't even try to kill sheep that are being protected by a Hungarian-bred guard dog called the Komondor. Such is the hope of SEA researchers who are currently testing the dog.

The western sheep industry is declining, and a major reason is the large number of sheep lost each year to coyotes. Since 1972, poisons have been federally banned, and guns, steel traps, and other lethal control methods have proved incapable of significantly reducing the loss.

Nonlethal control methods, such as repellants and sterilizing agents, need more development before being put to widespread use. Surprisingly little attention, however, has been given to the use of the guard dog, which traditionally has never been popular in this country.

Guard dogs have been bred for centuries in Europe and Asia to protect livestock from predators. The Hungarian Komondor was developed more than 200 years ago to be used against wolves.

A large and powerful dog—adult males stand a minimum of 25½ inches (63 centimeters) at the shoulders and weigh from 80 to 120 pounds (36 to 54 kilograms). Females are slightly smaller. The Komondor has a long, dense, shaggy outercoat that easily cords into ropelike tassels, and a soft wooly undercoat. Together, the two coats serve as armor that is all but impregnable to an enemy's teeth.

Wolves in Hungary challenged the Komondorok (plural form) for supremacy and, as a consequence, came close to extinction there. Coyotes are smarter than their wolfish overseas cousins and may recognize that discretion is often the better part of valor. It is expected that the shy coyotes will quickly learn to avoid confrontations with Komon-

dorok and return to their natural prey of rabbits and mice.

To protect sheep from coyotes, a dog must be socially attached to the sheep—treating the flock as its personal property. And the dog must be aggressive toward coyotes and other predators. Komondorok display such traits; they are courageous and faithful to their masters and over the years have been bred for self-reliance and intelligence, in addition to aggressiveness toward predators.

Although independent by nature and wary of strangers, Komondorok are reputedly easy to train. Dr. Philip N. Lehner, behavioral scientist with Colorado State University, Fort Collins, Colo., will evaluate the dog's temperament to determine the difficulty, if any, in handling a Komondor.

Lehner will also observe how coyotes

react to the Komondor's presence in a band of sheep. His work will be funded by SEA.

SEA veterinarian Norman Gates will be studying the effectiveness of the Komondor in preventing coyotes from attacking sheep under range conditions at the U.S. Sheep Experiment Station, Dubois, Idaho.

Dr. Gates figures that one pair of dogs will be needed to guard a band of sheep (1,000 ewes and their lambs). Since a Komondor puppy costs between \$250 and \$500 or more, this method would be a relatively inexpensive means of controlling coyote depredation on range sheep if it proves effective.

Dr. Norman Gates is located at the U.S. Sheep Experiment Station, Dubois, ID 83423.—L.C.Y.



Changing of the guard: A Komondor stands watch over a flock of sheep in SEA tests to determine whether this Hungarian-bred giant will be as formidable to American coyotes as it has been to European wolves (0678X724-7).



Cocklebur²¹⁴ Cut^{b.c. 36} Soybean Yields

COMMON cockleburs cut soybean yields by 43 percent where the weeds grew with the crop from planting time through the growing season. The weeds caused practically no yield losses if they were removed within the first 6 weeks of the growing season.

These observations were made where researchers had planted cockleburs at a rate of about one per 2 feet (61 centimeters) of 30-inch (76 centimeter) spaced rows in a joint Science and Education Administration and Illinois Agricultural Experiment Station study at Urbana. Similar observations had

been made in Southern States where environment and cultural practices differ from those of the Midwest.

In the 3-year study, SEA agronomist Loyd M. Wax and graduate assistant James R. Bloomberg transplanted about 3,600 2-day-old cocklebur seedlings per acre (21,000 per hectare) to silt loam plots 2 days after soybeans came up. They also transplanted the weed seedlings to different plots 1 to 10 weeks after soybean emergence.

Cockleburs that were planted 3 weeks or more after soybean emergence and were allowed to remain on the plots

through the growing season scarcely affected yields. But cockleburs planted immediately after soybeans reduced yield by 43 percent.

In another part of the study, season-long cocklebur competition reduced soybean yields by 49 percent. The scientists had planted cocklebur seeds and thinned the resulting weed population to about 3,600 plants per acre within 10 days after they came up in the plots. All of the cockleburs were removed from these plots 1, 2, 3, 4, 6, 8, or 10 weeks after soybeans came up or at harvest time.

Where the weeds had competed for 8 weeks or less, soybean yields generally were reduced by no more than 6 percent, Dr. Wax says.

Soybeans became tall and spindly when cocklebur competition lasted 10 weeks or longer. But the cockleburs grew even taller, shading the soybeans during flowering. The shading may have impeded photosynthesis, reducing sugar levels in soybean leaves and causing malnourished soybean pods to abort, says Dr. Wax. Cocklebur-free soybeans produced about a third more mature pods than soybeans with 10 weeks of cocklebur competition.

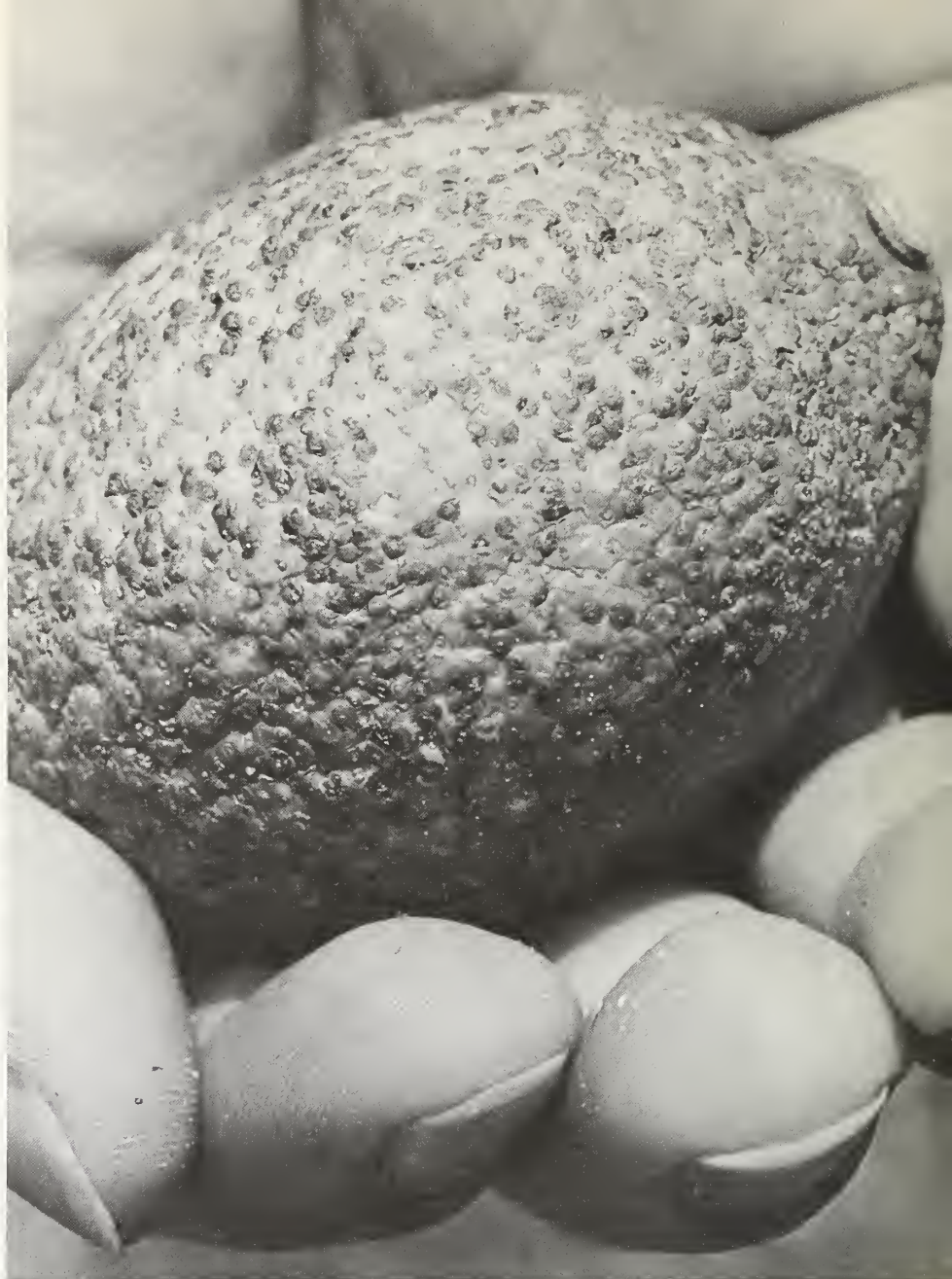
In a third part of the study, the federal and state scientists found that season-long competition failed to have much effect on pod production or soybean yields if cocklebur populations were held below some 1,500 plants per acre (3,600 plants per hectare).

Dr. Wax says that cockleburs may continually reinfest fields unless controls are applied persistently. Each of many burs produced by a cocklebur plant contains two seeds that may germinate months apart. Cockleburs that come up late in the season may produce seeds for reinfestations because the time for flowering and seed set is dependent on night length rather than the age of the weeds.

Dr. Loyd M. Wax's address is USDA-SEA, Room 215 Davenport Hall, University of Illinois, Urbana, IL 61801.—G.B.H.

Right: This lemon, infested by red scale, shows a little of what can happen if the insect goes unchecked (1178X1473-3).

Below: Dr. Moreno and biological aid Marcia Narog inspect oranges in a California orchard to check the rate of red scale infestation occurring naturally. Infestation rates are correlated with numbers of trapped males to provide a total red scale population projection (1178X1469-26).



Pheromone Aids Red Scale Control

IT MAY seem that \$250,000 is a lot of money to spend over 10 years looking for—and finding—a synthetic sex pheromone for the California red scale.

However, it is not much when that discovery could produce annual savings of \$9 million in California alone, says Dr. Daniel S. Moreno, SEA entomologist, Riverside.

The red scale is a serious pest of

citrus in the United States and most citrus growing areas around the world. It is a small insidious pest difficult to find visually and makes its presence known by infesting branches, twigs, fruit, and leaves; causing twig die-back; defoliation of major branches, and death of citrus trees if left untreated.

The legless sedentary insects live under a shell-like coat and feed by suck-



Above: How do male red scale respond to natural pheromones in an area saturated by synthetic pheromones? Biological aid Marcia Narog holds a lemon infested with virgin red scale females while hanging a trap also containing virgin red scale females. If males ignore these natural pheromones, this would demonstrate the effectiveness of the synthesized product and the confusion it can generate for male red scale (1178X1468-14).

ing the sap of citrus trees. Severe infestations of adult females and immature forms of the insect can defoliate and kill untreated trees in one year.

Males do not feed during the last half of their development and when they mature, they usually take flight for the sole purpose of mating and then die within 24 hours. Females can live up to 90 days under warm conditions and longer under cool conditions. When fertilized, each female can give birth to an average of 350 live crawlers. This is the only mobile stage of the female.

Because of the potential damage that the red scale can cause in citrus orchards, trees are generally sprayed once a year. Those chemical spray costs in California in 1975 were estimated at more than \$9 million.

However, with the use of a sticky trap baited with virgin female scales

or the new pheromone, scale populations can be measured more critically and, if deemed necessary, chemical sprays can be applied when scale populations are most susceptible. By using this approach alone, chemical sprays can be reduced to one every three years or oranges—a chemical spray reduction of 66 percent.

There are several benefits in using the synthetic sex pheromone: ease of finding new populations, accurate mapping of these populations in the orchard, accurate assessment of population densities which can decrease unnecessary sprays, early warning system, more timely sprays where necessary, availability of a cheaper trap as compared to virgin females, reduced costs of visual surveys and the elimination of insectaries used to produce virgin female scales. Cumulative benefits

Above: A male red scale mates with a virgin female as the female rotates into position underneath her scale cover. Males can mate as often as thirty times during their maturity, which generally lasts from 2 to 6 hours depending on the season and climate (PN-4172).

per year are estimated at \$9 million.

SEA, under the terms of a cooperative agreement and memorandum of understanding from the California Citrus Research Board, enlisted Dr. Wendell Roelofs from Cornell University, Geneva, N.Y., to isolate, identify and synthesize the sex lure produced by virgin female red scale. The isolation and identification was made from natural pheromone produced by virgin females. A total of 400 million female day equivalents were collected by Dr. Moreno by passing purified air over



the virgin females. The air was then pulled through a molecular sieve that trapped the pheromone; extractions were made from the molecular sieve, tested for activity and sent to Dr. Roelofs for isolation and identification.

Dr. Roelofs began the project in 1971, identified the pheromone in April 1976 and synthesized it by November 1976. The synthetic pheromone can be manufactured at pennies per dose.

Costs of traps to hold the lure and the cost of sticky cards is another matter; presently research is underway to come up with a more efficient and

cheaper trap design.

Dr. Moreno, who has researched the use of the pheromone trap from the time of its inception, recommends growers place about one trap for every two acres for detection and one trap every acre for survey and monitoring.

The "old" pheromone trap was much more complicated than putting synthetic pheromones on a rubber cap and inserting them in a trap.

Before the development of the synthetic lure, insectaries were set up by eradication districts and commercial entrepreneurs to mass rear virgin females on lemons. The lemons contain-



Above: Laboratory helper Christine Sances evaluates the residual activity of the new synthetic pheromone after being exposed to various climatic conditions for several weeks. The large wheel-like structure makes a complete revolution every hour to bring each pheromone sample equally close to red scale populations being reared on shelves along the wall (1178X1472-5).

Above Right: Agricultural research technician James Rich counts red scale trapped on sticky cards baited with the synthetic pheromone and left in orchards. Less than 1 millimeter in length, the adult male red scale must be viewed with a microscope for accurate identification (1178X1471-15).

Lower Right: A pheromone-collecting jar is prepared by biological aid Marcia Narog. After lemons infested with virgin females are put into the jar, red scale pheromones are distilled from the air through a vacuum process and then tested for potency. If males respond, the pheromones are sent to a commercial firm for synthesis (1178X1470-29).

ing the mature virgin females were then placed in ice cream carton traps to lure males. Males are caught on a sticky card on the trap.

The number of males caught is directly correlated to population density on infested fruit and twigs and therefore indicates whether or not the area needs spraying.

Before the development of the trap, visual inspections were made in orchards to detect or find scale infestations, an almost impossible task. The insectaries are operated by costly personnel and in the case of eradication districts "live" red scale females could, with injury to the trap, be left in the field and become part of the problem rather than a solution.

Dr. Moreno's work with insect be-

havior regulators started in the late 1960's to aid growers' problems with the red scale by regulating scale populations. In 1967, the researchers discovered that the unmated females produced a sex pheromone to attract males. By 1971, they demonstrated the use of the female traps in the field to detect and survey populations.

The approach proved profitable and the so-called eradication districts have saved growers millions of dollars by not having to generally control the scale but rather suppress and confine the existing populations to the small infested acreage.

Now, with the availability of a synthetic pheromone uses can be expanded and, perhaps, can be added—control.

To accomplish control with sex pheromones, "male confusion" can be used.

According to Dr. Moreno, this simply consists of interrupting the sexual communication cues between females and males by saturating the environment with synthetic sex pheromone.

When the male enters such an environment, he finds it difficult to locate virgin females. In addition, if the females are not mated, they are more susceptible to stresses in the environment including a tiny wasp that will not lay eggs on mated females.

Dr. Moreno is stationed at the University of California, P.O. Box 112, Boyden Entomology Laboratory, Riverside, CA 92521.—*J.P.D.*

Pesticides in Runoff Water

THE application and confinement of pesticides to intended target areas has been a concern of researchers and applicators since the development of pesticides. Pesticides in water draining from farm fields after a rain have been intensively studied for over a decade. This research has provided many answers to nonpoint source pollution of water by pesticides. R. Don Wauchope, research chemist, has compiled an ex-

tensive review of pesticide runoff data which suggests "rules of thumb" for predicting runoff losses for a given pesticide application.

For the majority of commercial pesticides, total losses of one-half percent or less of the applied amounts are the rule, unless severe rainfall conditions occur within 1–2 weeks after application. Exceptions are organochlorine insecticides, which may lose one percent regardless of weather because of their long persistence; and soil surface applied, wettable powder formulations of pesticides which may lose up to 5 percent, depending on weather and slope. This is because the powders are easily dislodged from the soil surface by rain.

Persistence is the key factor in the total pollution potential of a pesticide. Most pesticide applications leave a certain fraction of the pesticide in highly "available" state on soil or crop surfaces, which is easily washed off by rain. However, since most pesticides in use today are relatively nonpersistent, the probability is that much of the pesti-

cide will be degraded before rainfall occurs. Most studies indicate that the degradation rate of the "available" fraction is much faster than the degradation rate of the pesticide as a whole—90 percent disappearance of the available fraction within a few weeks is typical.

Research is underway on the effect of altered tillage practices using minimum tillage and soil conservation measures on runoff water quality. Studies have shown that only the most insoluble pesticides (10 ppm or less), or those pesticides which bind strongly to clay particle surfaces such as arsenical herbicides and paraquat are carried off "piggyback" fashion in the sediment phase of the runoff. The majority of pesticides are lost by water runoff. Unless water losses from fields are also controlled, soil erosion control solves only one phase of the problem.

Dr. R. Don Wauchope is located at the Southern Weed Science Laboratory, P.O. Box 225, Stoneville, MS 38776.—*E.L.*

Metrically Packaged Grapefruit

RECENT tests indicate that a new international size shipping container for grapefruit is not only feasible, but is slightly superior to conventional containers.

Why the emphasis on international specifications?

The market value of fresh grapefruit exported from Florida alone is expected to exceed \$50 million by 1980.

And foreign importers may have a lot to say in the future about how the fruit is packed and handled.

Says SEA agricultural marketing specialist Philip W. Hale: "We have been testing metric containers and pallet bases recommended by the Organization for Economic Cooperation and Development (OECD). This organization was originally composed of western European countries, and—importantly for the U.S.—Japan."

In four shipping tests to evaluate conventional and metric-size containers, "Marsh" grapefruit were packed in the boxes and tested under commercial conditions from Florida to Tokyo.

The 50 x 30 cm metric boxes were unitized on international size 120 by 100 cm (47.24 by 39.37 inch) wood pallets. The 50 by 30 cm box and the 120 by 100 cm pallet are recommended by OECD and the International Organization for Standards for use in international trade for packing and handling fresh fruits and vegetables.

Both the 50 by 30 cm container and the conventional container are full-telescope single-wall, fiberboard containers. The inside dimensions of the metric box are 47.0 by 26.7 by 25.4 cm as compared to 43.2 by 27.0 by 25.7 cm for the conventional box. Thus, the metric box has about 6.2 percent more overall space than the conventional containers. The boxes have the same size ventilation slots in each side panel of the containers. Both covers are fabricated from 200-lb (90 kilogram) test fiberboard, and the bodies from 350-lb (157.5 kilogram) test fiberboard.

The grapefruit for both the experimental and conventional boxes, obtained from commercial packing-houses, were washed, treated with fungicides, waxed, graded, sized, and packed in the test shipping containers. As required by the Japanese government, the grapefruit was fumigated with ethylene dibromide after packing at the Florida Division of Plant Industry Fumigation Station.

Nine boxes each of palletized 50 by 30 cm boxes and individually hand-stacked conventional boxes were specially identified to measure their effect on grapefruit deformation. These boxes were placed in the bottom, third, and fifth layers (next to the sixth, or top layer) of their respective stacks, three boxes per layer. Fruit from these boxes was later examined by USDA researchers for slight and serious deformation on arrival in Tokyo.

In all tests, slightly less deformation of fruit was found in the experimental boxes, unitized, as compared to fruit packed in the conventional export boxes and individually handstacked in the holds of refrigerated ships.

Serious deformation for fruit packed in the 50 by 30 cm boxes averaged 4.8 percent compared with 7.0 percent for fruit shipped in the conventional 4/5 bu boxes.

Seriously deformed fruit was more prevalent in the bottom layer of the shipping container, regardless of the type of container. Most of this damage was attributed to fruit pressing into the bottom gap of the shipping container body. Fruit in the top layer of the boxes was generally not deformed.

There was an increase in the amount of serious deformation from the fifth to the bottom layer of fruit in the 50 by 30 cm boxes.

"It should be pointed out that after the 50 by 30 cm boxes are packed, placed on the pallet, and unitized, they remain in that layer position throughout the entire marketing system until they reach their final destination. Conversely, the conventional 4/5 bu boxes are handled individually and are subjected to different layer positions," said Mr. Hale.

Mr. Philip W. Hale collaborated on the study with plant pathologist Dr. John J. Smoot at SEA's U.S. Horticultural Research Laboratory, 2120 Camden Rd., Orlando, FL 32803, and SEA agricultural economist William R. Miller in Rotterdam, The Netherlands.—*P.L.G.*

White Winter Wheat Bran Promising

BRAN from a hard white winter wheat under development at Kansas State University, Manhattan, appears promising for food uses in limited SEA tests.

Bran from white wheat is preferred in processed foods because it is lighter in color than red wheat bran and at least as mild in flavor. Only red wheats are grown in the central U.S. grain belt, although white club wheats are produced in the Pacific Northwest. A hard white winter wheat selection, KS72516, under evaluation by Kansas State agronomist Elmer G. Heyne, may be the first white wheat for the Great Plains, possibly by the mid-1980's.

SEA chemist Byron S. Miller compared bran from KS75216, Newton hard red winter wheat, Waldron hard red spring wheat, and Moro white club wheat at the U.S. Grain Marketing Research Laboratory.

Bran of KS72516 approached that of Moro in color. Composition of the bran samples was not greatly different.

A taste panel, working under a red light that masked differences in appearance of coded samples, found no significant difference in flavor between KS75216 and Moro brans or between KS75216 and Newton brans.

KS75216 and Newton are selections of a spring wheat developed by the International Maize and Wheat Improvement Center (CIMMYT) in Mexico crossed to Scout hard red winter wheat. Scout was developed by USDA and University of Nebraska agronomists at Lincoln.

Dr. Byron S. Miller is at the U.S. Grain Marketing Research Laboratory, 1515 College Avenue, Manhattan, KS 66502.—*W.W.M.*

Desiccant-type Pesticides as Aids to Cotton

MATURITY of cotton plants is sometimes delayed, and some top bolls may not be open enough for machine harvesting before the first hard freeze. This often means a serious economic loss to the cotton farmer.

Scientists at the U.S. Delta States Agricultural Research Center report that some desiccant-type harvest aid chemicals can speed up the reluctant bolls without any detrimental effects on fiber or seed quality.

If the process of boll dehiscence (opening) is related to dehydration, as previously suggested by researchers, a desiccant chemical applied to these unopened bolls would accelerate the process. "This should be especially true when the environment is not right for rapid drying—such as heavy rains," said plant physiologist George W. Cathey.

One greenhouse study was conducted to measure moisture loss from the bur (the envelope of the boll) and seed cotton fractions of treated and untreated bolls during the final stage of maturity. Plants were taken outside the greenhouse and sprayed at the rate of 187 liters per hectare (the rate that would be used in the field) with a 1.5 percent aqueous solution of arsenic acid.

In two field studies, plants were sprayed with either arsenic acid, paraquat (1,1'-dimethyl-4, 4'-bipyridium), or sodium chlorate at 6.72, 0.14, and 5.39 kilograms per hectare, respectively. The effect of these desiccant chemicals was then determined on yield, fiber proper-

ties, and the opening rate of bolls that developed late in the growing season.

Drying of untreated greenhouse-grown cotton bolls prior to opening occurred primarily in the interior or seed cotton fraction of the boll. Moisture content of the bur remained at near 80 percent until just before opening; moisture in the seed cotton fraction declined at a near linear rate from 78 percent in 38-day-old bolls to 53 percent in 50-day-old bolls.

Among bolls treated with arsenic acid, moisture loss was accelerated for both the bur and seed cotton fraction, but more so in the bur.

Boll opening on field-grown plants in both years was influenced by weather, but the opening rate during both years was hastened in plots treated with arsenic acid or paraquat.

In the sodium chlorate plots, the differences were significant in only one year.

In both years the most effective desiccant in the field was arsenic acid.

"None of the chemicals had any adverse effects on any yield component or fiber property," said Mr. Cathey.

George W. Cathey is with the U.S. Delta States Agricultural Research Center, Cotton Physiology and Genetics Laboratory, P.O. Box 225, Stoneville, MS 38776. Mr. Cathey worked in cooperation with researchers at the Delta Branch of the Mississippi Agricultural and Forestry Experiment Station.—*P. L. G.*

New Market for U.S. Cherries

JAPANESE citizens can now, for the first time, buy U.S.-grown sweet cherries in their own country. This signals the beginning of a multimillion dollar annual export market for the U.S. sweet cherry industry.

The key to opening up this new market was the development by SEA and Washington State University researchers of a methyl bromide fumigation treatment that achieved complete control of codling moths in sweet cherries with no bad effects on fruit quality or taste (see AGR. RES., Sept. 1976, p. 11.).

Japan, the only major fruit-growing nation in the world that does not have codling moths, had been quarantining U.S. sweet cherries and other deciduous fruits because of a codling moth presence in our fruit.

The first shipment of U.S. cherries went to Japan last summer, and U.S. officials estimate the 1978 sweet cherry shipments to Japan reached about 1,400

tons (583 metric tons) valued at over \$2 million. The market should get much bigger. With a population of 120 million and a domestic cherry industry whose harvest ends at about the time U.S. production is peaking, the Japanese, potentially, can absorb as much of our cherries as U.S. growers care to ship.

The lifting of the cherry quarantine is the first time Japan has modified its regulations against the codling moth. When the fumigation treatment proved successful, the quarantine had to be removed because under treaty agreements, it is illegal for either the United States or Japan to maintain artificial trade barriers.

SEA entomologist Harold R. Moffitt, Yakima, Wash., led the development of the methyl bromide treatment and also played a key role in negotiating the removal of the quarantine. Dr. Moffitt says that in addition to codling moths, the treatment controls the western

cherry fruit fly, another cherry pest that concerned the Japanese.

When the first cherry shipments arrived in Japan, they were inspected for quality by SEA plant pathologist Charles F. Pierson, Wenatchee, Wash.

Moffitt and a Yakima team of SEA researchers plan next to determine the dosages of methyl bromide needed on cherries over a wide range of temperatures for moth and fly control, and to look into the possibility of fumigating cherries after packing. All of this will be done to provide the U.S. cherry industry greater flexibility in its operations.

The SEA researchers also hope to develop treatments that will allow the removal of Japanese quarantines on walnuts, plums and nectarines.

Dr. Harold R. Moffitt is located at 3706 West Nob Hill Blvd., Yakima, WA 98902.—L.C.Y.

Sources of Ornithosis Identified

HOUSE CATS, opossums, egrets and grackles are potential sources of continuing ornithosis infection in turkeys, followup studies after an outbreak in South Texas indicate. The outbreak involved 8,000 tom turkeys, of which 8 percent died.

In an early investigation of the out-

break, SEA microbiologist Leslie A. Page isolated virulent chlamydiae, the bacteria causing ornithosis in turkeys, from a house cat and an opossum that were scavaging dead turkeys on a farm. Later, he isolated chlamydiae from egrets nesting nearby. Dr. Page then demonstrated experimentally that each of these species excreted virulent chlamydiae from their intestines for up to 6 weeks after infection.

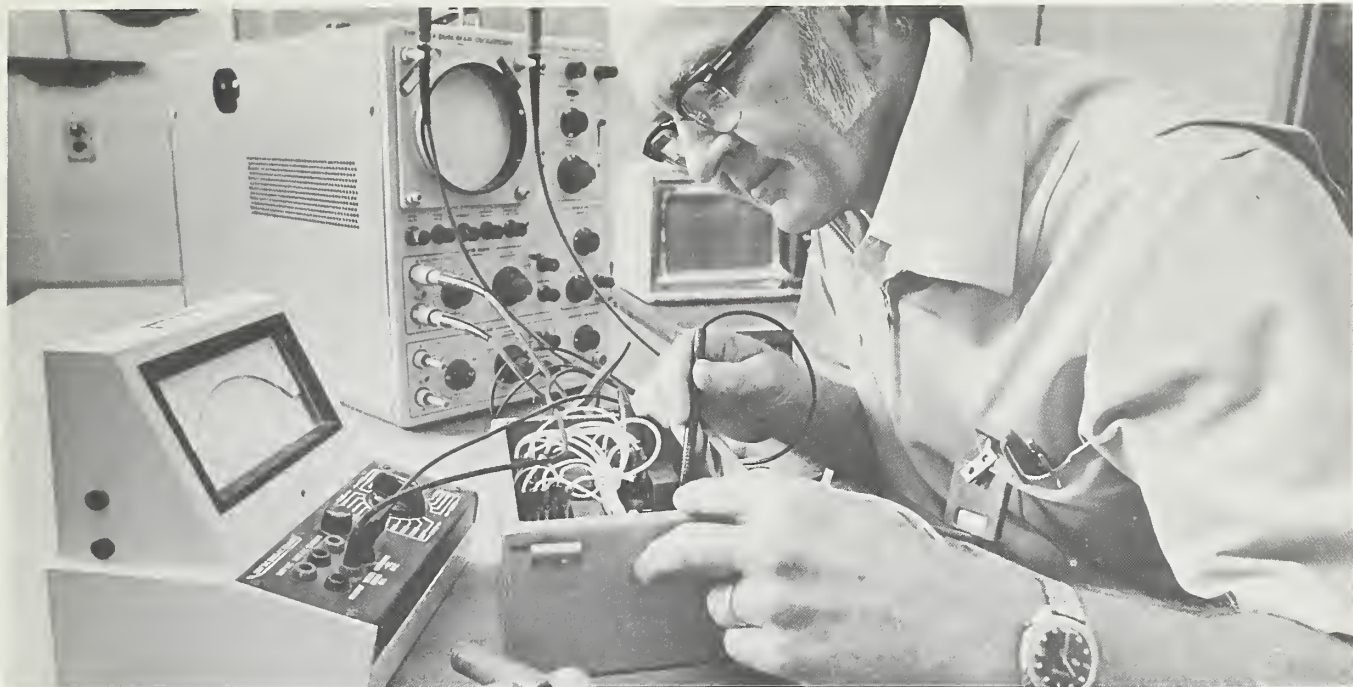
Under contracts with SEA, biologist Stanley Parker of Texas A & M University, Kingsville, collected live birds, blood, and tissue samples from wildlife on the Falfurrias, Tex., farm where the outbreak occurred. Veterinary microbiologist James E. Grimes of Texas A & M University, College Station, tested the samples for residual infection.

In the 12 months after the outbreak, the scientists collected 432 tissue samples and 431 blood samples from 26 species of wild birds and rodents on

the farm. Dr. Grimes did not isolate chlamydiae from any sample. But positive reactions to diagnostic blood tests indicating previous exposure to chlamydiae were found for 30 percent of the house mice, 15 percent of the blackbirds, and 11.5 percent of the grackles sampled. In addition, Dr. Grimes demonstrated that experimentally infected wild grackles transmitted virulent chlamydiae to domestic turkeys when the birds were housed together. Chlamydiae did not survive in the soil of pens after the infected turkeys were treated and removed.

The original wildlife carriers that transmitted the infection to domestic turkeys were not pinpointed, says Dr. Page, but the studies identified other wild species capable of perpetuating the disease locally.

Dr. Leslie A. Page is at the National Animal Disease Center, P.O. Box 70, Ames, IA 50010.—W.W.M.



New Energy Saving Thermostat

AN ENERGY-**SAVING** thermostat has been developed to control both heating and ventilating in poultry and livestock shelters.

Called the "dual-stage, time-proportioning thermostat" by SEA agricultural engineer Floyd N. Reece who developed it, the thermostat can control both heating and ventilation functions with a single temperature adjustment.

Reece points out that sometimes both heating and ventilation may be required to maintain temperature and proper humidity in a building. If separate, conventional thermostats are used to operate the heaters and fans, both may operate at the same time and waste energy. If, on the other hand, the separate conventional thermostats are adjusted to prevent overlap, the temperatures may vary too much.

The newly developed thermostat maintains close temperature control without wasting energy.

"The principle behind the new ther-

mostat is a fixed-length time cycle," says Reece. "The thermostat has the ability to sense temperature and can divide the time cycle into appropriate segments. It then automatically operates switches that start and stop the ventilation fans and heating equipment so that there is no overlap.

"We used the thermostat successfully for 2 years with our limited-area brooding research. We found that a 5-minute cycle is best for our poultry house, but for a small livestock shelter a shorter time cycle might work better.

"The increasing cost of energy," Reece continued, "makes precise control of heating and ventilation in poultry and livestock houses highly desirable. The new thermostat gives us that control."

Mr. Floyd N. Reece is located at the South Central Research Laboratory, Mississippi State, MS 39763.—*B.D.C.*

Above: Before installing his new thermostat, Mr. Reece checks its electrical circuitry which controls heating and ventilation alike. The thermostat was constructed from standard parts available at most electrical supply stores (1078X1337-17).

Below: Mr. Reece adjusts thermostat to respond to temperature changes of plus or minus 2½° F. Copper tubing coiled below the thermostat leads to a temperature sensing bulb (1078X1337-28).





AGRISEARCH NOTES

Vitamin E Helps Hamsters

A DISEASE that has seriously interfered with the commercial production of hamsters can be prevented by supplementing pregnant females' diets with vitamin E during early pregnancy.

Spontaneous hemorrhagic necrosis (SHN) is a progressive fatal disease affecting the central nervous system of hamsters in the fetal stage. Entire litters may be born with the disease and none of the offspring may reach adulthood. Hamsters are critical for human medical research because their reactions to new treatments are so similar to human reactions.

No one knows the precise cause of SHN, but SEA chemist Richard F. Keeler, Logan, Utah, and veterinarian Stuart Young, with the Colorado State University at Fort Collins, noted similarities between SHN and vitamin E deficiency disease in chicks.

In a series of experiments, the researchers found that administering high level dosages of vitamin E to female hamsters prevents the occurrence or reduces the severity of SHN in their fetuses and improves the post-weaning viability of their litters.

Although vitamin E is capable of totally preventing SHN disease in fetal hamsters, Keeler and Young detected no concrete evidence in their study that SHN is exclusively a vitamin E deficiency disease.

In an earlier study, Keeler and

Young learned that different strains of laboratory hamsters displayed different degrees of susceptibility to SHN. They feel that the best way to prevent future bouts of SHN will be to genetically select for less susceptible hamster strains and use a high-level vitamin E supplement during gestation and lactation.

Dr. Richard F. Keeler is located at the Poisonous Plant Research Laboratory, 1150 East 14th North, Logan, UT 84322.—*L.C.Y.*

Clover Germplasm Resists Aphids

INITIALLY, only 27 of 10,885 red clover plants examined showed resistance to the yellow clover aphid. Four more cycles of selection from progeny of these 27 plants built up resistance to 95.6 percent.

Starting with the third cycle of selection, SEA geneticist Herman J. Gorz, SEA entomologist George R. Manglitz, and University of Nebraska geneticist Dr. Francis A. Haskins each time screened progeny of previously selected plants for resistance to the pea aphid as well. Pea aphid resistance was thus built up from 27.5 percent to 93.7 percent.

The 198 plants resulting from five generations of selection for resistance to the yellow clover aphid as well as three generations of selection for pea aphid resistance were randomly inter-

crossed to form the N-2 germplasm, released to red clover breeders by SEA and the University of Nebraska, Lincoln.

The initial 10,885 plants varied widely in origin and adaptation. They represented 35 germplasm sources, including 14 varieties, 13 breeders' improved strains, plant introductions, and random crosses of plants in a large introduction nursery. The first selection of 27 plants narrowed the germplasm to 13 maternal sources, and only six of these sources were represented in the 322 plants surviving the fourth cycle of selection.

Dr. Herman J. Gorz is at Room 329, Keim Hall, University of Nebraska East Campus, Lincoln, NE 68583.—*W.W.M.*

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

